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where

$$y = Ax + Bx^2 + Cx^3 + Dx^4 + \dots, \quad (1)$$

$$A = 1 + c_1 \sum_{i=1}^m \frac{1}{b_i} + c_1 \sum_{i=2}^n \frac{1}{c_i} = c_1 \left[\sum_{i=1}^m \frac{1}{b_i} + \sum_{i=1}^n \frac{1}{c_i} \right]$$

and B, C, D, \dots are all positive.

Since each of the series formed from $\frac{1}{1-x/c_i}$ converges in the interval $0 \leq x < c_k$, the power series (1) will converge in this interval. And, since in (1) A is not zero, there is one and only one solution for x in terms of y , and this solution may be obtained as a power series in y convergent for sufficiently small values of y .

Let

$$x = \alpha y + \beta y^2 + \gamma y^3 + \delta y^4 + \dots. \quad (2)$$

Substitute (2) in (1), equate coefficients of like powers of y , and obtain

$$\alpha = \frac{1}{A}, \quad \beta = -\frac{B}{A^3}, \quad \gamma = \frac{2B^2}{A^5} - \frac{C}{A^4}, \dots$$

That is

$$x = \frac{1}{A} y - \frac{B}{A^3} y^2 + \left(\frac{2B^2}{A^5} - \frac{C}{A^4} \right) y^3 + \dots$$

or

$$\frac{1}{A} - \frac{x}{y} = \frac{B}{A^3} y - \left(\frac{2B^2}{A^5} - \frac{C}{A^4} \right) y^2 + \dots \quad (3)$$

Thus

$$\lim_{y \rightarrow 0} \frac{x}{y} = \frac{1}{A} = \frac{1}{c_1 \left(\sum_{i=1}^m \frac{1}{b_i} + \sum_{i=1}^n \frac{1}{c_i} \right)}.$$

For sufficiently small values of y the right member of (3) is positive. Hence, for small values of y , the value of x/y is always less than $1/A$.

NOTES AND NEWS.

EDITED BY E. J. MOULTON, Northwestern University, Evanston, Ill.

Dr. G. H. LIGHT has been promoted from assistant professor to associate professor of mathematics at the University of Colorado.

The fellows in mathematics at the University of Chicago for next year are Miss GLADYS GIBBENS, Mrs. MAYME I. LOGSDON, and Mr. FRANK E. WOOD.

Dr. C. C. CAMP, who recently returned from war service in France, has been appointed instructor in mathematics at the University of Illinois.

At Brown University Captain R. W. BURGESS, now of the Bureau of Statistics, Washington, and Dr. R. E. GILMAN have been appointed assistant professors of mathematics, and Mr. C. R. ADAMS instructor.

At Cornell University Assistant Professor F. R. SHARPE has been promoted to a full professorship and Mr. V. G. GROVE, of the University of Kentucky, has been appointed instructor.

Dr. E. A. KIRCHER, now in the employ of the National City Bank, New York City, has been appointed instructor of mathematics at Yale University.

Mr. C. A. NELSON has been appointed instructor of mathematics at the University of Kansas.

Mr. A. D. CAMPBELL, now instructor in mathematics at Cornell University, has been appointed instructor at Yale.

Dr. G. W. MULLINS of Barnard College, Columbia University, has been promoted to an assistant professorship of mathematics.

At Harvard University, Assistant Professor G. D. BIRKHOFF has been promoted to a full professorship, Messrs. B. H. BROWN, C. A. RUPP, and R. S. TUCKER have been appointed instructors in mathematics, and Dr. I. A. BARNETT and Dr. H. C. M. MORSE have been appointed Benjamin Peirce instructors in mathematics. Professor H. N. DAVIS, assistant professor of physics since 1910, has been appointed professor of mechanical engineering.

At the Massachusetts Institute of Technology the following instructors in mathematics have been appointed for next year: Mr. RAYMOND DOUGLASS, of the University of Maine; Dr. J. S. TAYLOR, of the University of California, and Dr. NORBERT WIENER, of Harvard University. Assistant Professor H. C. BRADLEY of the department of drawing and descriptive geometry has been promoted to an associate professorship; in the same department Mr. S. A. BREED has been appointed instructor.

The following announcements come from the mathematics department of the University of Minnesota. Assistant Professor DUNAHM JACKSON, of Harvard, has been appointed to a professorship. Major W. L. HART has been appointed to an assistant professorship. Mr. R. W. BRINK has been promoted to an assistant professorship, and given leave of absence for a year to enable him to accept a lectureship at the University of Edinburgh. Dr. C. H. YEATON has been appointed as an instructor to take Mr. Brink's place for the year 1919-1920. Miss MINNA J. SCHICK has been appointed instructor for the first Quarter of 1919-1920, as a substitute for Professor G. N. BAUER who is absent on leave until January 1, 1920.

Professor F. E. MILLER, head of the department of mathematics in Otterbein College and a charter member of the Association, died March 26, 1919.

On March 28, Major J. L. COOLIDGE, of Harvard University, commenced a course of lectures (twice a week) at the University of Paris on "Geometry in the complex domain."

Of the six three-hour examinations held at Annapolis this month for the

purpose of selecting instructors of mathematics at the Academy, one was on theoretical mechanics as in Miller and Lilly's *Analytic Mechanics*, and another was on strength of materials and hydromechanics as in Smith's *Strength of Material* and Alger's *Hydromechanics*. The other examinations were on differential and integral calculus as in Granville's work, analytic geometry as in Smith and Gale's *New Analytic Geometry*, trigonometry as in Brown's *Trigonometry and Stereographic Projections*, and Wentworth, *College Algebra* (revised), 1902, and Wentworth's *Solid Geometry* (revised), 1909.

Higher Educational Circular No. 14 issued in February, 1919, by the Bureau of Education, Washington, gives an account of advanced educational work at the Bureau of Standards where, during the past ten years, graduate courses in physics, mathematics, and chemistry have been maintained. Seventeen men have used investigations made at the Bureau for their doctoral theses. Eleven of these have received credit for attendance upon the lecture courses at the Bureau. Courses requiring considerable mathematical development, such as advanced optics, and thermodynamics have been given; but the emphasis in these courses was primarily upon the physics. The following courses in pure and applied mathematics have been offered recently: 1917-18—Least squares by Dr. P. W. MERRILL, Bureau of Standards; Electrical oscillations by Dr. LOUIS COHEN, Signal Corps; Introduction to mathematical physics by P. G. AGNEW, Bureau of Standards; Electric waves by Professor W. S. FRANKLIN, Massachusetts Institute of Technology. 1918-19—Advanced differential equations by Major F. R. MOULTON, University of Chicago; Introduction to mathematical physics by Professor J. S. AMES, Johns Hopkins University.

In addition to the reports of summer courses in mathematics given in the March, April and May numbers of the *MONTHLY*, we have the following:

Leland Stanford University: June 17-August 30. Professor H. F. BLICHFELDT, Algebra (4 units); coördinate geometry (4 units); Reading course.

University of Pennsylvania: July 8-August 16. Professor G. H. HALLETT: Elementary algebra (to quadratics); plane trigonometry; analytic geometry; higher calculus. Professor H. H. MITCHELL: College algebra; differential calculus; integral calculus; mathematical theory of probability. Professor R. L. MOORE: Elementary algebra (quadratics and beyond); plane geometry; solid geometry; introduction to the theory of functions of a complex variable.

University of Michigan, June 29-August 2. Professor W. W. BREMAN: Geometry and Algebra for teachers (2 hours credit); differential equations (2 hours). Professor T. L. MARKLEY: Theory of functions of a complex variable (2 hours credit); algebra (2 hours); modern geometry and analytic geometry of three dimensions (2 hours). Professor L. C. KARPINSKI: Elementary algebra (for entrance); history of mathematics (2 hours credit). Professor C. J. COE: Algebra (2 hours credit); Analytic geometry (4 hours); Professor V. C. POOR: Integral calculus and differential equations (four or five hours credit). Dr. G. H. CRESSE: Plane Geometry (for entrance); plane trigonometry (two hours

credit). Dr. E. S. ALLEN: Solid geometry (for entrance). Dr. R. B. ROBBINS: Mathematical theory of statistics (two hours credit); introduction to the mathematical theory of interest (two hours); introduction to the mathematical theory of life insurance (two hours). Dr. A. L. NELSON: Elementary course in differential and integral calculus (four or five hours credit). Dr. L. J. ROUSE: Analytic geometry (continuation of Professor Coe's course—four hours credit).

In addition to those recorded in our last issue, as having been elected fellows of the National Academy of Sciences at the April meeting, mention should be made of Professor E. J. WILCZYNSKI, University of Chicago.

At the May meeting of the American Academy of Arts and Sciences, Professors JOSEPH LIPKA, G. A. MILLER, F. R. MOULTON, and VIRGIL SNYDER were elected Fellows in Class I, section 1—Mathematics and Astronomy.

To the Division of Physical Sciences of the National Research Council the American Mathematical Society elected Professors E. W. BROWN, L. E. DICKSON, and H. S. WHITE, as representatives; the American Physical Society elected Professor E. B. WILSON. Professor Wilson is a member of the Executive Committee of the Division.

At the seventeenth annual meeting of the Association of Teachers of Mathematics in New England held at Boston University, May 3, 1919, Miss FLORENCE P. LEWIS, exchange professor from Goucher College at Wellesley College, presented a paper entitled "History of the parallel postulate," and Professor C. L. BOUTON, of Harvard University, discussed "Photogrammetry." Professor W. R. RANSOM, of Tufts College, is president of the Association.

At the Educational Congress held under the direction of The University of the State of New York in Albany, May 19th to 28th, the papers read included the following by members of the Association: "Mathematical Requirements" by Professor J. W. YOUNG and President F. C. FERRY; "Mathematics in the Junior High School" by Mr. WILLIAM BETZ; "Mathematics of the Senior High School of the Future" by Professor H. E. HAWKES; "Experiments in Teaching Secondary Mathematics" by Miss VEVIA BLAIR; "Applied Mathematics in High School Courses" by Professor W. E. BRECKENRIDGE; "Projects for Mathematical Research" by Professor D. E. SMITH; "Training of Mathematics Teachers" by Professors R. C. ARCHIBALD and HARRY BIRCHENOUGH.

The Association of Teachers of Mathematics in the Middle States and Maryland held a joint meeting with the Association of Mathematics Teachers of New Jersey at Newark, N. J., on May 3. The program included: "Test of intelligence for admission to college," by Professor A. L. JONES, Columbia University; "Certain undefined elements and tacit assumptions in the first book of Euclid's Elements,"—the presidential address of the New Jersey Association—by Mr.

H. E. WEBB, Central High School, Newark, N. J.; "On Newton's method of approximation," by Dean H. B. FINE, Princeton University; "Some illustrations of statistical methods," by Mr. P. C. H. APPS, Newark, N. J.

The two hundred and third regular meeting of the American Mathematical Society at New York City was held on April 26, 1919, at Columbia University. Twenty-three papers of the usual research nature were presented. In addition to these papers, Professor DUNHAM JACKSON and Dr. T. H. GRONWALL gave reports on work in ballistics at Aberdeen and Washington. Attending members of the Society took luncheon and dinner together at the Faculty Club. A full report of the meeting will be found in the *Bulletin of the American Mathematical Society*.

SUMMER MEETING OF THE ASSOCIATION.

The fourth summer meeting of the Association will be held at the University of Michigan, Ann Arbor, Michigan, on Thursday and Friday, September 4-5, 1919. It will immediately follow the meeting of the American Mathematical Society to be held at the same place September 2-4. A joint meeting of the two organizations will be arranged for Thursday afternoon, and a joint dinner for Thursday evening. Detailed programs of the meeting will be mailed to all members of the Association at a later date, but it may be announced at this time that general arrangements have already been made for the accommodation of attending members. For this purpose, both the Helen Newberry Residence and the recently built Michigan Union Building will be available. The rates for rooms in Newberry Residence will be one dollar per day; in the Michigan Union Building, one dollar and fifty cents per day. Meals will be furnished under the auspices of the Michigan Union at reasonable rates. Special provisions will be made for ladies and married couples.

Ann Arbor is on the main line of the Michigan Central Railroad and of the Ann Arbor railroad.

The American Astronomical Association will meet in Ann Arbor probably from Monday to Wednesday of the same week.